Appendix A – Forest Plan Monitoring and Evaluation Plan

Forest Plan monitoring is an integral part of the adaptive management cycle that guides future management decisions and actions. Adaptive management includes defining measurable objectives, monitoring, learning and changing, and recognizing uncertainties that may affect achievement of objectives and achievement or maintenance of desired conditions. Periodic evaluations summarizing the monitoring results will be reviewed by the Forest Supervisor and other managers to determine if any changes are needed in management actions, or plan components.

The Forest Plan Monitoring and Evaluation Plan is designed to measure the degree to which on-the-ground management is maintaining or making progress toward the Forest Plan desired conditions and objectives. This monitoring plan will test assumptions, track changes, and measure management effectiveness, primarily through status and trend monitoring and effectiveness monitoring. The monitoring plan provides a framework that will be supplemented by more specific monitoring plans and protocols. It will be adjusted as needed to respond to new information and unanticipated changes in conditions.

The Forest Plan Monitoring and Evaluation Plan is a subset of the monitoring for the LTBMU. Additional, project-specific monitoring may be required for some projects, including monitoring required through regulatory permitting processes. While inventories and implementation monitoring are important and will continue to be implemented, they are generally not included in this monitoring plan because they only indirectly inform progress towards the Forest Plan desired conditions and objectives. . Inventories describe how much or how many of a given resource is present, while implementation monitoring describes how well management direction and intent was followed in projects and activities.

The LTBMU also participates in multiple broad-scale monitoring efforts. Some, but not all of these are included in the Monitoring Plan. For example, the LTBMU is an active partner in providing information to the Tahoe Regional Planning Agency for monitoring attainment of TRPA's environmental thresholds through the tracking and reporting of the Environmental Improvement Program performance measures, but these activities are not included in the Monitoring Plan.

The Monitoring Plan presented below describes the program area associated with the monitoring, monitoring questions, associated indicators or performance measures, a cross-reference to the plan component(s) being monitored, and the frequency of monitoring and reporting (annual or other time period). It also documents the source – (i.e. who does the monitoring) which may be the LTBMU, the Pacific Southwest Region, or a collaborative effort.

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Air Quality: DC1	O3 injury to pine	What is the status and trend of O3 injury to pine?	USFS (RO), TRPA	Life of plan	4 to 5 yrs	4 to 5 yrs
Air Quality: DC1	N compounds, O3 concentrations, and lichen analysis	What is the status and trend of N compounds and 03?	USFS (RO)	Life of plan	4 to 5 yrs	4 to 5 yrs
Air Quality: DC1	Acid deposition	What is the status and trend of acid deposition?	USFS (RO, PSW Station)	Life of plan	4 to 5 yrs along with N compounds monitoring	4 to 5 yrs
Air Quality: DC2	California Regional Haze State Implementation Plan goal	Is visibility improving and data following the Regional Haze glide path, if not what are possible stressors related to LTBMU activities?	USFS (RO), TRPA, CARB	Life of plan	Continuously	Annually
Soil Quality DC 4,5, 6,&7	Soil cover, soil physical properties, national disturbance monitoring protocol.	Is soil quality being maintained such that the productivity of the land is not substantially or permanently impaired?	USFS (LTBMU)	Life of plan	Annually	Every 2 years – as required by planning regs
Water Quality: DC 9, 10 **Soil Quality: DC8(erosion only and by inference only)**	BMPEP Evaluations.	To what degree are best management practices implemented and effective in protecting soil and water resources for LTBMU management activities?	USFS	Life of plan	Annually	Annually
Water Quality: DC10 **Habitat and Species Diversity DC50, DC51, DC53, DC54, DC59, DC61**	Macroinvertebrates – SWAMP Bioassessment Protocol	What is the status and trend of the biological integrity of LTB tributaries, and to what degree may LTBMU activities be related to changes in status and trends?	TRPA	Life of plan	Annually	TRPA Threshold Attainment Reporting Schedule
Hydro & Geomorphic Process: DC12	Tributary water quality (multi/agency), aquatic habitat condition, channel geomorphic condition, degree of watershed disturbance, forest health (see WCA protocols)	Is watershed condition improving in the Lake Tahoe Basin, as evaluated through Watershed Condition Ratings, particularly in priority watersheds?	USFS	Life of plan	5 yrs	5 yrs
Forest Veg – Forest Structure DC 23	Seral Stage/ Percent	Are the seral stage percentages for a major forest type within the historic reference condition?	USFS (R5-Ecology, RSL, LTBMU)	Life of plan	5 to 10 yrs	5 years as part of TRPA Common Vegetation Threshold, & annually in FACTS based on accomplishments on LTBMU
Forest Veg - Forest Composition DC 23	Forest Type/ Proportion of Total Acres of Major Forest Types	Are the proportions of each major forest type in the Basin within the historic range?	USFS (RSL)	Life of plan	5-10 yrs	5 years as part of TRPA Common Vegetation Threshold

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Forest Veg - Forest Stand Resilience DC 23, 24	Mortality-Actual/ Trees Per Acre	Are levels of tree mortality, by causal agent, at background levels?	USFS (RSL, S&PF-FHP)	Life of plan	Annually	Reported annually as the Annual Mortality Report from Forest Health Protection
Forest Veg – Urban Forest Parcels DC 20, 22	Parcel Condition related to forest health (hazard trees, invasive plants, insects & disease), fuel accumulation, hydrologic condition (erosion), & encroachments	What is the condition of urban forest parcels, i.e. what is the management need for the parcel?	USFS	Life of plan	4-6 yrs depending on proximity to developed private lands	5 yrs
Forest Veg DC 22 OBJ 5	Annual prescribed fire acres;	Are planned and unplanned ignitions being used to meet or trend towards resource goals? Are we meeting prescribed fire objectives?	USFS	Life of plan	Annual	5 years
Habitat & Species Diversity: DC53, DC61	MIS habitat and population distribution at the bioregional scale	What are the trends for Management Indicator Species at the bioregional (Sierra Nevada) scale?	USFS (RO) / Partners; *MIS monitoring is conducted at the Sierra Nevada scale, including sampling on the LTBMU; see DEIS for more information.*	Life of plan	1-3 yrs	1-3 yrs
Habitat & Species Diversity: DC53, DC54, DC59, DC60, DC61 Forest Veg DC 46	TEPCS Census Counts	What is the status and trend in TEPCS plant populations and communities within the Lake Tahoe Basin?	USFS (LTBMU)	Life of Plan	Annually (not every species or site will be monitored annually)	5 yrs
Habitat & Species Diversity: DC53, DC57, DC60, DC64	Density, Plant Size, & demographic structure of TESPC plant species most likely impacted by changing climate (e.g. Tahoe draba, long petaled lewisia)	What is the status and trend of TES plant species most likely impacted by changing climate?	USFS (LTBMU)	Life of Plan or until species is removed from TES or SI list	5 yrs	6 yrs

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Habitat & Species Diversity DC50, DC51, DC53, DC59, DC61, DC63 **Invasive Species Management DC68, DC69, DC70** **Species Refuge Area: DC75** **Hydro & Geomorphic Process: DC15**	Stream Temperature Monitoring: temperature	Are stream temperatures suitable for life history of native aquatic species? What is the status and trend of these native aquatic and nonnative aquatic species most susceptible to changing climate?	USFS (LTBMU)	Life of Plan	Annually (not every site will be monitored annually)	5 yrs
Habitat & Species Diversity: DC53, DC46, DC61	Photo-monitoring, cover/presence of key indicator species	What is the status and trend of Grass Lake (RNA) and Hell hole (critical habitat) fen ecosystems? Are changes in climate influencing community trends?	USFS (LTBMU)	Life of Plan	5 yrs	6yrs
Habitat & Species Diversity: DC54, DC55 **Species Refuge Areas: DC77**	TYC population estimate (through census or other sampling methods) and habitat assessment	What is the status and trend of Tahoe yellow cress? Are core sites adequately protected?	TAG team with LTBMU partner	Life of Plan	Set of conditions based on lake level	Annually when survey is conducted
Habitat & Species Diversity: DC58, DC59, DC60 **Species Refuge Areas: DC78, DC79, DC80**	Whitebark pine stand conditions	What is the status and trend of whitebark pine, incidence of blister rust, and infestation of bark beetles? Is regeneration sufficient for the sustainability of whitebark pine in the LTB?	USFS (FHP, R5-Ecology, LTBMU)	Life of Plan	Annually (not every stand every year)	5 yrs

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Invasive Species Management: DC68, DC69, DC70 **Habitat & Species Diversity: DC50, DC51, DC53, DC59, DC63** **Species Refuge Areas**: **DC75, DC76** **Recreation Opportunities DC83, DC84** **Interpretive Services and Conservation Education DC97, DC98, DC99, DC100**	Invasive species sites/acres, new detections	What is the status and trend of invasive species within the Lake Tahoe basin? Are education, prevention, and treatment measures effective at preventing and reducing the spread of aquatic and terrestrial nonnative invasive species?	Coordination with Basin Invasive groups, LTBMU partner	Life of Plan	Annually (not every species or every site will be monitored annually)	5-6 yrs
Species Refuge Areas: DC76 **Habitat & Species Diversity: DC53, DC59**	Amphibian visual encounter surveys: number of amphibians, demographics, presence of Bd (chytrid fungus) [includes western toad and MYLF]; number of fish	What is the current status of amphibian, including Sierra Nevada (mountain) yellow-legged frog (SNYLF), populations and critical habitat in the Lake Tahoe basin and how are they changing over time? What is the distribution of Bd around the basin and infection level?	USFS (LTBMU); CA Dept. of Fish and Wildlife; USFWS	Life of Plan	Annually (not every species or site will be monitored annually)	5 yrs
Habitat & Species Diversity: DC50, DC51, DC54, DC61 **Hydro & Geomorphic Process: DC16, DC17**	Ecological condition of streams using established protocols (e.g. SCI)	What are the current physical and biological condition of streams and associated floodplains in the Lake Tahoe basin, and how is that condition changing over time? To what degree have restoration efforts been successful in restoring floodplain connectivity and channel/riparian habitat, improving water quality, stabilizing stream banks and sediment transport regimes?	Basin M&E; USFS (LTBMU)	Life of Plan	At least twice during the life of the plan selected SCI sites will be visited	10 yrs

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Species Refuge Areas: DC75 **Habitat & Species Diversity: DC59**	Number of self-sustaining sub-populations LCT	Have recovery actions resulted in an increase in LCT abundance and associated native non-game species and decrease in non-native salmonids? Does the LCT population have multiple age and size classes as a positive population response to brook trout removal? Are we meeting recovery objectives?	US Fish and Wildlife, in collaboration with USFS (LTBMU) and partners	Life of Plan, or until recovery actions are achieved	Annually (not every site or entire site each year)	5 yrs
Habitat & Species Diversity: DC59, DC61, DC60	Number of detections, nests, and or roosts	What is the status and trend of select invertebrate and vertebrate TEPCS populations in the Basin?	USFS (LTBMU)	Life of Plan or until species is removed from special status list	Annually (not every species or site will be monitored annually)	Annually
Forest Veg: DC40, DC41, DC42, DC43, DC44,DC45, DC46 Objective Forest Veg and Fuels: 13 **Habitat & Species Diversity: DC53, DC61** Objective BIO: 17, 19	Acres/sites restored; number of Willow Flycatcher (WIFL) sites	What is our progress towards maintaining and improving willow and aspen habitats within the Basin?	USFS (LTBMU)	Life of plan	When plan is adopted and then every 2 years	5 years

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Habitat & Species Diversity; Vegetation: DC58, DC60, DC23 Standard and Guidelines: - When creating openings to restore forest structure/forest health use the group selection with reserve prescription within the mid seral stage…. -Select locations of openings (early seral creation or type conversion) on a project-specific basis and as part of the IDT process.… - When designing forest health treatments (thinning) that would reduce canopy cover and/or basal area, minimum canopy cover and basal area…. -In late seral stands occupied by late seral associated species, limit canopy cover and basal area reduction to levels that maintain or improve habitat conditions ... - Design vegetation treatments…	Acres of early seral forest and forest openings (less than 1 to 10 acres) created within each watershed; proportion of early stage/openings created adjacent to mid seral, early seral, late seral, urban; nearest detection of sensitive wildlife species	What progress has been made towards protecting and maintaining late seral habitat connectivity?	USFS (LTBMU, RSL, PSW)	Life of plan	Starting 10 years after Plan is adopted and then every 5 years.	5 years

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Habitat & Species Diversity: DC50, DC51, DC52, DC53, DC59, DC61 **Vegetation: DC46** **Species Refuge Areas: DC76** **Soil Quality: DC4, DC6, DC7, DC8** **Water Quality: DC11** **Hydro & Geomorphic Process: DC14**	Intensity of winter recreation use (e.g. groomed cross-country trails, OSV); sensitive resource presence; compaction; water quality.	Is resource damage occurring from winter recreation use?	USFS (LTBMU)	Monitoring would occur where known OSV use occurs in occupied habitat and/or suitable habitat or where future OSV expansion occurs	Baseline, every 3 yrs	5 years
Habitat & Species Diversity: DC71, DC72, DC73, DC74 Objectives BIO PACs and HRCAs: 24, 25 Standard and Guides: 87, 90, 91, 92	Species presence (e.g., spotted owl) ; canopy cover, basal area, structural complexity of understory (e.g., snags, downed wood, saplings), tree size class distribution	What progress has been made and what is the success towards maintaining/improving the habitat condition of PACS?	USFS (LTBMU)	Life of Plan	Selected project(s) that have occurred both within and outside a PAC to provide information needed for effectiveness of plan S&G	Pre- and post-project, then up to 5 monitoring periods over a course of up to 10 years
Recreation Opportunities: DC84	National Visitor Use Monitoring (NVUM)	What is the trend of visitor use, visitor satisfaction, and progress toward meeting recreation objectives in the plan?	USFS (WO, LTBMU)	Life of Plan	5 yrs or agency standard	5 yrs or agency standard
Recreation Development: DC92	INFRA and SUDS (square ft. of parking, infrastructure, permitted acres). GIS. Track deferred maintenance costs over time; special use permits administered to standard; expired special use permits.	How are recreation facilities contributing to the plan's desired condition(s) and objective(s) socio-economic sustainability?	USFS (LTBMU)	Life of Plan	Annual	5 yrs or agency standard
Wilderness: DC130	Visitor satisfaction surveys, campsite condition inventories)	What level of solitude and primitive and unconfined type of recreation opportunities are visitors experiencing?	USFS (LTBMU)	Life of Plan	Annual or as described in Wilderness Management Plans	5 yrs or agency standard

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Access & Travel Management: DC111	NVUM indicators of satisfaction; ATM project analysis	Does the managed route system meet public access and resource management needs?	LTBMU	Life of plan	Every 5 years	Every 5 years
Access & Travel Management: DC111 **Built Environment: DC115**	facility condition index; road and trail deferred maintenance	Are maintenance levels sufficient to support existing infrastructure (e.g. roads, trails, facilities)	LTBMU	Life of plan	Annual	Every 5 years

Tier 2 Monitoring Elements

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Air Quality: DC1	O3 injury to pine	What is the status and trend of O3 injury to pine?	USFS (RO), TRPA	Life of plan	4 to 5 yrs	4 to 5 yrs
Air Quality: DC1	N compounds, O3 concentrations, and lichen analysis	What is the status and trend of N compounds and 03?	USFS (RO)	Life of plan	4 to 5 yrs	4 to 5 yrs
Air Quality: DC1	Acid deposition	What is the status and trend of acid deposition?	USFS (RO, PSW Station)	Life of plan	4 to 5 yrs along with N compounds monitoring	4 to 5 yrs
Air Quality: DC2	California Regional Haze State Implementation Plan goal	Is visibility improving and data following the Regional Haze glide path, if not what are possible stressors related to LTBMU activities?	USFS (RO), TRPA, CARB	Life of plan	Continuously	Annually
Habitat and Species Diversity: DC53, DC57, DC61, DC64	Freel Peak GLORIA - biodiversity	What is the status and trend of high elevation communities and risks to these communities due to changing climates?	USFS (PSW, R5 Ecology)	Life of Plan	5 years	Unknown
Forest Veg DC 22	Severity proportions burned by wildfires	Do wildfire severity proportions resemble desired fire regime?	USFS	Life of plan	Post-fire	5 years
Habitat & Species Diversity: DC53 **Forest Veg: DC46**	Meadow Monitoring Region 5 Range monitoring protocol: Species composition, ground cover, wetland rating, vegetation rating, ecological status	What is the current condition and ecological status and trend of wetlands (e.g., wet meadows, fens, marshes, etc.) in the Lake Tahoe basin, based on key indicators of biological integrity and water quality, and how is that condition changing over time? Are changes in climate influencing wetland trends? What is the ecological condition and trend in meadow systems where grazing has been removed or restoration has occurred?	USFS (LTBMU; RO)	Life of Plan	5 yrs	6 yrs
Protected Activity Center: DC71	California Spotted Owl; Northern Goshawk	What is the status and trend of California Spotted Owl and Northern Goshawk populations in the Basin?	USFS (RO)	Life of Plan or until species is removed from TES or SI list	3 times in 10 years monitoring plan - protocol developed by PSW (each of the 3 times is a 2 year protocol so 6 times in 10 years), annually known nests	10 years
Habitat & Species Diversity: DC56 Standards and Guidelines 41, 52, 55, 58, 59, 60,61, 62	Change in species presence (e.g. black backed woodpecker, CA spotted owl) associated with snag habitat; number of snags retained or created, size of snags, spatial distribution	What progress has been made towards protecting/maintaining habitats with snags and CWD (e.g. burned forests, insect outbreaks, late seral)?	USFS or PSW	Pre and post project	Selected project(s) to provide information needed for effectiveness of plan S&G on burn forest habitat protection	

Desired Conditions	Indicator/Measure	Monitoring Question(s)	Responsible Agency	Monitoring Time Frame	Frequency of Monitoring	Frequency of Reporting
Habitat & Species Diversity: DC53, DC57, DC592, DC61 **Invasive species: DC68, DC69, DC70** **Species Refuge Areas: DC77**	Species presence, species condition, distribution and abundance of invasive	How do new recreation expansion and/or improvements of existing recreation influence the presence and/or condition of sensitive species? Are these conditions supporting conservation of sensitive species?	USFS (LTBMU)	Pre- and post-project	Selected project(s)	

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